



LAWRENCE  
LIVERMORE  
NATIONAL  
LABORATORY

# Battery electrode preparation, assembly, and testing procedures: $\text{LiFePO}_4$

Y. Wang

June 14, 2013

## **Disclaimer**

---

This document was prepared as an account of work sponsored by an agency of the United States government. Neither the United States government nor Lawrence Livermore National Security, LLC, nor any of their employees makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States government or Lawrence Livermore National Security, LLC. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States government or Lawrence Livermore National Security, LLC, and shall not be used for advertising or product endorsement purposes.

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

**LLNL Subcontract for LDRD 12-ER-053:  
Battery electrode preparation, assembly, and testing  
procedures:  $\text{LiFePO}_4$**

**Yan Wang, Ph.D., Assistant Professor  
Worcester Polytechnic Institute  
100 Institute Road, Worcester, MA 01609**

**Subcontract Report for  
Drs. Ming Tang and Brandon Wood, LLNL**

## **LLNL Subcontract Report**

**Yan Wang, Ph.D., Assistant Professor**

**Worcester Polytechnic Institute**

**100 Institute Road, Worcester, MA 01609**

We have hosted and trained LLNL postdoc (Dr. Jianchao Ye) in my group at WPI for battery electrode preparation, battery assembly and testings and Dr. Ye should have the capability to do all the tests now. We also tested 5 LiFePO<sub>4</sub> samples from LLNL. The following are the experimental results.

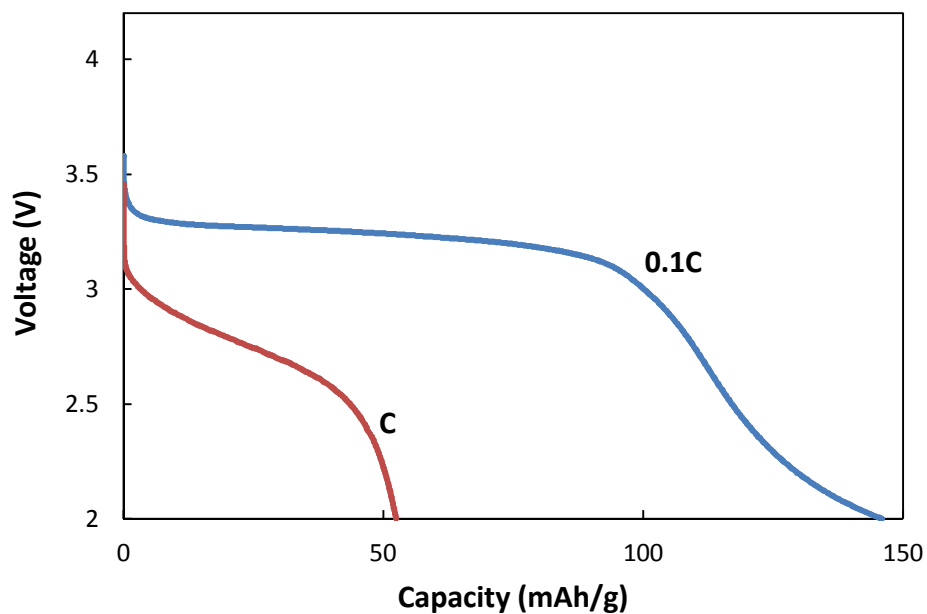
### **Preparation of samples**

Super C65 and PVDF were mixed, and then LFP was added into the mixture and mixed. The resulting slurry was pasted on the Al current collector (For uniform of electrode, two tape strips were used to fix Al current collector). The resultant was dried in oven. The dried electrode was punched into 1/4 inch disks for cell assemblies.

### **Electrochemical characterization**

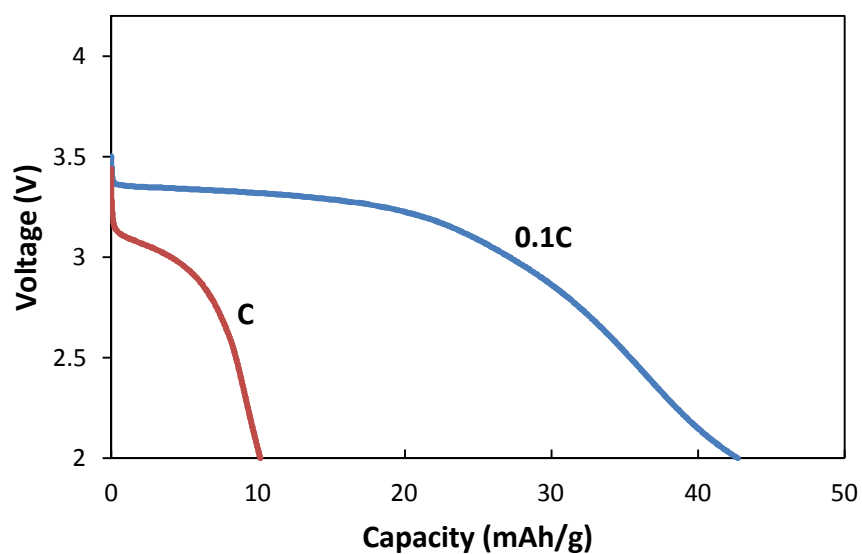
Each LFP disk was electrochemically tested against Li foil in a Swagelok cell with stainless-steel current collectors. A piece of Li foil was pressed onto a collector, two pieces of Celgard 2500 microporous separator placed over it, a piece of the cathode disk centered over the separator, and cell was sealed with pressure to ensure good contact between the disk and the other collector. 1M LiPF<sub>6</sub> electrolyte solution in ethylene carbonate (EC), diethyl carbonate (DEC), and dimethyl carbonate (DMC) (1:1:1) was used to fabricate cells. Each cell was tested with a galvanostat/potentiostat/impedance analyzer (Bio-logic VMP3). CC charging was used until cell voltage reached 4.2 V. Each cell was discharged to 2.0V.

## Results



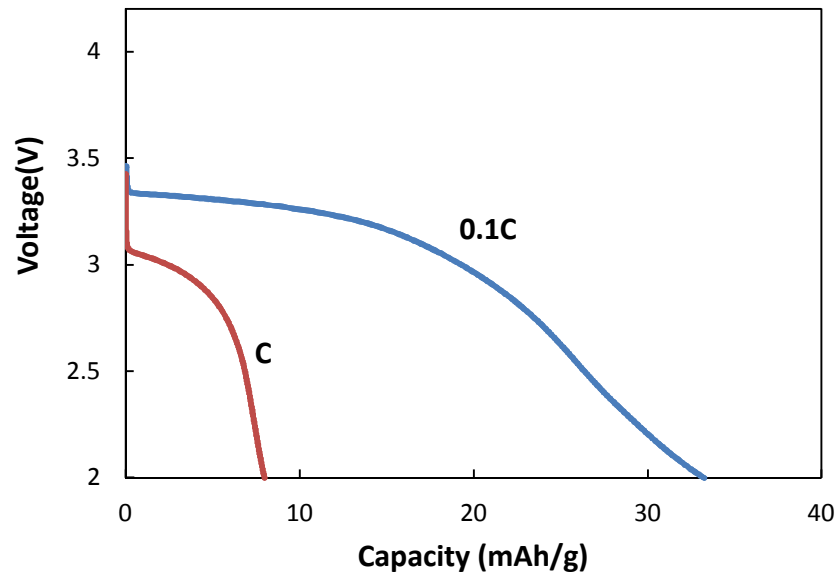
**Fig. 1.** Discharge curves of LFP-080712-HT-600 at current rate C/10 and C.

Fig. 1 showed the discharge curves of LFP-080712-HT-600 at C/10 and C. At 0.1C, specific capacity was 146 mAh/g, and only 52 mAh/g was maintained at C.



**Fig. 2.** discharge curves of LFP-080712 at current rate C/10 and C.

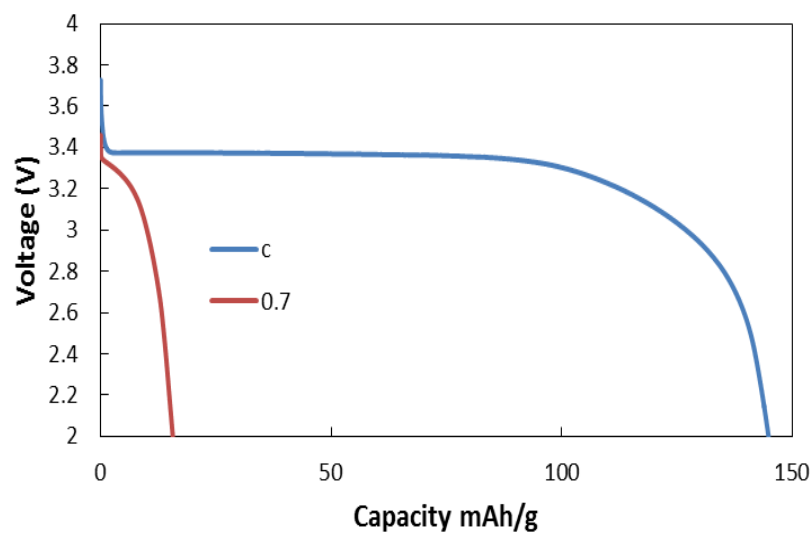
Fig. 2 showed the discharge curves of LFP-080712 at C/10 and C. While at 0.1C specific capacity was 42 mAh/g, it was 10 mAh/g at C.



**Fig. 3.** Discharge curves of LFP-1024 at current rate C/10 and C.

Fig. 3 showed the discharge curves of LFP-1024 at C/10 and C. At 0.1C, specific capacity was 33 mAh/g, and at C, it was only 8 mAh/g.

## Previous results



**Fig.4.** Discharge curves of LFP-C and LFP-0.7 at current rate C/10.

Fig. 4 showed the discharge curves of LFP-C and LFP-0.7 at C/10 and C. Specific capacity of LFP-C was 144 mAh/g, and for LFP-0.7, it was only 15 mAh/g.